International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 3215-3218

Received: 15-07-2018
Accepted: 20-08-2018

Manish Songara
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Arun Kumar Jhirwal
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Subhash Chander Goswami
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Ram Avtar Legha
Equine Production Campus, ICAR-National Research Centre on Equines (NRCE), Jorbeer, Bikaner, Rajasthan, India

Vijay Kumar
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Vikramjit Singh
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Geetesh Mishra
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Correspondence
Arun Kumar Jhirwal
Department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan, India

Growth and digestibility of gross nutrients by azolla incorporation in Marwari stallion

Manish Songara, Arun Kumar Jhirwal, Subhash Chander Goswami, Ram Avtar Legha, Vijay Kumar, Vikramjit Singh and Geetesh Mishra

Abstract
The present investigation was carried out with the objectives of studying the effect of Azolla supplementation on feed utilization and growth rate parameters of Marwari stallions. The 3 Marwari stallions were subjected to a switchover technique of feeding in which they were fed with basal feed for 45 days (trial I), then for next 45 days feeding trial 10% of total concentrate feed protein was replaced by Azolla supplementation (trial II). The proximate analysis of *Azolla pinnata* in terms of DM, CP, EE, CF, TA and NFE were 6.7, 25.40, 13.17, 3.60, 15.42 and 42.41, respectively on % DM basis. A digestibility trial was conducted to determine the digestibility of different nutrients towards the end of the each feeding trial. There was no significant difference between two groups in terms of body weight of animal groups under trial, total dry matter intake, FI/100kg B.wt/d, digestibility of DM, CP, CF, EE, TA and NFE on DM (%) basis. During both feeding trial, average body weight was recorded fortnightly and result revealed that there was no significant difference between two groups in terms of growth rate.

Keywords: azolla, digestibility, feeding trials, supplementation

Introduction
The gap between the demand and supply of feed is also increasing for horses as increased density of these species. The estimates by different group of researchers have consistently pointed out the deficit of the feed resources for livestock in terms of dry roughages, greens and concentrates. Conventional sources of feeds are not enough to mitigate the shortage of feeds and fodder for sustainable animal production. In order to bridge this gap and to ensure optimum production the use of non-conventional feed resources as supplement or replacement of conventional feed without compromising the quality is the area of focus in recent years. Azolla is important among aquatic plants due to the occurrence of both photosynthesis and nitrogen fixation in the leaves and also because of its growth habits, it appears a greater potential than tree leaves as a source of protein minerals and vitamins for animals. Azolla is rich in protein, essential amino acid, vitamins, growth promoter intermediaries and minerals like calcium, phosphorus, potassium, ferrous, copper, magnesium.

Materials and Methods
The proposed investigation was conducted at the department of Livestock Production Management, College of Veterinary and Animal Science, Bikaner and Equine Production Campus (EPC), ICAR-National Research Centre on Equines (NRCE), Jorbeer, Bikaner. Three Marwari stallions of 4-6 years of age reared at EPC, ICAR-NRCE under standard managemental conditions were used in the experiments.

Propagation of azolla
Azolla had been propagated in nine ground pits of different dimensions and four cement tubs at the Azolla Production Unit established at EPC-NRCE, Bikaner.

Experimental procedure
The stallions were subjected to a switchover technique of feeding in which they were fed with basal feed for 45 days (trial I), then for next 45 days feeding trial 10% of total concentrate feed protein was replaced by Azolla supplementation (trial II). The effect of Azolla supplementation on feed utilization was studied.

Experimental feeding

In the present experiment, National Research Council (NRC) standards (2007) for feeding were followed and the animals were subjected to switch-over technique of feeding as given in table 1.

Table 1: Feeding schedule and ration composition during the whole feeding trial.

Time	Ration	Composition (Control Group)	Composition (Azolla fed Group)
9.00 h & 18.00 h	Concentrate mixture	Gram 30%, Wheat Bran 27%, Oats Grain 40%, Salt 2% & Min. mix 1%	Gram 30%, Wheat Bran 27%, Oats Grain 40%, Salt 2% & Min. mix 1% (As 90% Protein supplement)
9.00 h	Azolla green	-	As 10% protein replacement of Conc. Mix
11.00 h	Green Fodder	Sorghum green	Sorghum green
14.00 h	Dry Fodder	Wheat straw & Groundnut Haulm (50:50 ratio)	Wheat straw & Groundnut Haulm (50:50 ratio)

Collection of samples

Collection of Azolla samples

The fresh biomass of Azolla harvested, washed to remove the extraneous materials and the fresh weight was recorded to determine the biomass yield using weighing machine. The harvested Azolla *pinnata* was dried under shade to remove moisture and oven dried at 45°C for 3 days. The oven-dried sample was ground to 1 mm size and further used for proximate analysis.

Sampling, processing and storage of feed and faeces samples

Feeds and their respective residues were collected in separate polythene bags daily for DM estimation. These samples were pooled at the end of the collection period and ground to pass through 1 mm screen and preserved in air tight polythene bags for analysis of proximate principles. Faeces voided during 24 h was collected and weighed at 9:00 A.M. daily.

After thorough mixing a suitable aliquot ($1/50^{th}$) from each animal was taken in pre-weighed aluminum tray and kept in hot air oven at 100ºC for drying till constant weight. After drying the sample weight was recorded. At the end of the collection period, the dried faeces was pooled and ground to pass through 1 mm screen and stored in clean plastic jars and analyzed for proximate principles.

Experiments

Proximate analysis of Azolla

All the samples were chemically analyzed for the crude protein (CP), crude fibre (CF), total ash (TA), ether extract (EE) and moisture according to methods of Association of Official Analytical Chemists (AOAC, 2005) [1].

Feeding trial

Two feeding trial for a period of 45 days was conducted including a 7 days digestibility trial which was conducted towards the end of each experimental trial.

Weighing of the animals

The Stallions were weighed at fortnightly on a weighing balance before offering the feed and water. Initial body weight of the Marwari stallions was noted before the start of the experiment.

Digestibility trial

A digestibility trial of five days of collection period was conducted on the Marwari horses to determine the digestibility of different nutrients by conventional total faces collection method. During the trial samples of feed and fodder offered, orts left and faeces voided were collected. Samples of feed and faeces were analysed for proximate principles (AOAC, 2005).

Result and Discussion

A feeding trial for a period of 90 days was undertaken in this present investigation with the objective to study the effect of *Azolla pinnata* supplementation to Marwari stallions on growth rate.

The average fortnightly body weight (kg) changes of stallions in both groups, during the experimental period have been presented in Table 2 and Fig 1.

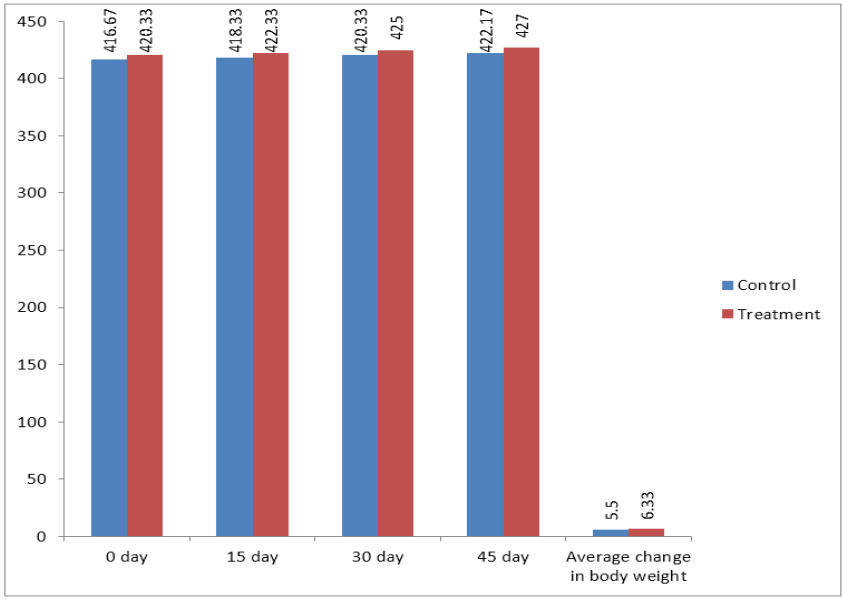

Fig 1: Changes in body weight of the control and treatment groups during the feeding trial

Table 2: Changes in body weight of the control and treatment groups during the feeding trial

Interval	Control	Treatment	Statistical difference
0 day	416.67±36.67	420.33±36.83	NS
15 day	418.33±36.83	422.33±36.83	NS
30 day	420.33±36.83	425.00±36.50	NS
45 day	422.17±36.67	427.00±36.50	NS
Average change in Body weight	5.50±0.29	6.33±0.88	NS

The average cumulative weekly body weight gained (Kg) by Marwari stallions in both groups, during the experimental period has been presented in Table 2.

Digestibility Trial

A digestibility trial of five days collection period was conducted on the experimental animals in control and treatment groups towards the end of the feeding trial. The result of the digestibility trial has been presented and discussed first, in order to get an idea about the nutrient utilization during feeding trial. The feeding scale of Marwari stallions at the time of digestibility trial has been given in Table 3.

Table 3: Feeding scale of the control group and Azolla fed group.

Groups	Name of the animals	Body weight of animals	Concentrate mix. (kg)	Green Fodder (kg)	Dry Fodder (kg)	Azolla (kg)
Control group	Mohit	380.00	3.75	9.50	3.00	-
	Ritik	380.00	3.75	9.50	3.00	-
	Sultan	490.00	4.90	12.30	4.00	-
Azolla fed group	Mohit	383.00	3.31	9.50	3.00	3.15
	Ritik	385.00	3.32	9.50	3.00	3.15
	Sultan	494.00	4.27	12.30	4.00	4.00

Chemical composition of feed and fodder

All the feeds offered to the Marwari stallions during the feeding and digestibility trial were analyzed for their proximate composition estimated during the trial period have been shown in Table 4.

Table 4: Proximate composition of ration used in the trial

Feed	Dry Matter (%)	Crude Protein (%)	Crude Fibre (%)	Ether Extract (%)	Total Ash (%)	NFE (%)
Concentrate	95.16	15.47	10.02	1.84	1.24	71.43
Green Fodder	23.09	8.26	34.14	5.19	9.20	43.21
Dry Fodder	95.62	8.77	39.87	4.06	16.42	30.88
Azolla	6.70	25.40	13.17	3.60	15.42	42.41

Digestibility of nutrients

The values for the digestibility of various nutrients in the mature Marwari stallions fed concentrate mixtures along with dry fodder, green fodder and green fodder like *Azolla pinnata* have been presented in Table 5 and Fig 2.

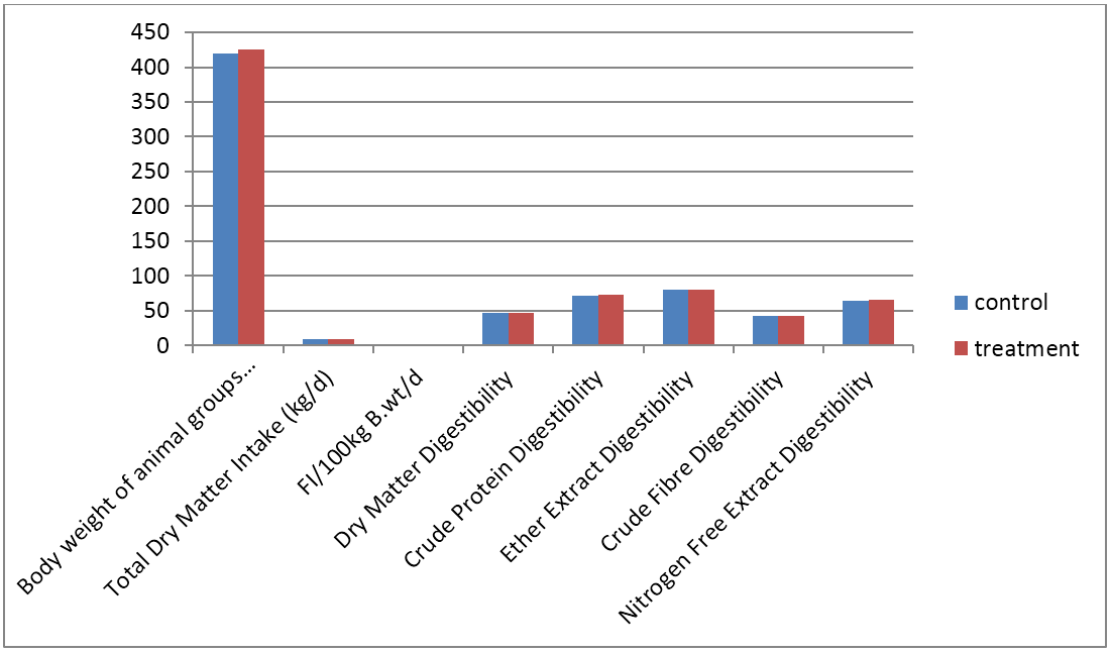

Fig 2: Feed intake and nutrients digestibility by control and Azolla supplemented groups

Table 5: Feed intake and nutrients digestibility by control and Azolla supplemented groups.

Parameters	Control Group (Mean±S.E.)	Treatment Group (Mean±S.E.)	Statistical significance
Body weight of animal groups under trial	420.33±36.86	425.00±36.50	NS
Total Dry Matter Intake (kg/d)	8.49±0.73	8.66±0.74	NS
FI/100kg B. wt/d	2.04±0.01	2.06±0.01	NS
Dry Matter Digestibility (%)	46.98±0.40	47.39±0.57	NS
Crude Protein Digestibility (% DM)	72.04±0.56	72.65±0.56	NS
Ether Extract Digestibility (% DM)	80.00±0.24	80.15±0.16	NS
Crude Fibre Digestibility (% DM)	42.11±0.50	42.01±0.42	NS
Nitrogen Free Extract Digestibility (% DM)	64.97±0.19	65.19±0.31	NS

Body weight of animal groups under trial

The similar results were reported by earlier reported by Khare (2014) in crossbred female calves and Roy *et al.* (2016) in Hariana heifers by incorporation of Azolla in the concentrate mixture.

Dry matter digestibility

Similar to findings of present investigation non-significant effect Azolla feeding on dry matter digestibility was reported by Khare (2014) [5] and Arvindraj (2012) [2] in crossbred female and male calves, respectively.

Crude protein digestibility

The result reported was similar to the findings of Khare (2014) [5] and Arvindraj (2012) [2] in crossbred female and male calves, respectively.

Ether extract digestibility

Arvindraj (2012) [2] reported that there is no significant difference in ether extract digestibility in growing crossbred male calves in the control and treatment (Azolla supplemented) groups.

Crude fiber digestibility

Similar to the findings of present investigation Arvindraj (2012) [2] and Ghodake *et al.* (2012) [3] in crossbred male calves and Osmanabadi kids, respectively. In contrary to the findings of present investigation Khare (2014) [5] and Indira *et al.* (2009) reported that supplementation of Azolla in diet of growing crossbred female calves and buffalo calves, respectively, has significant effect on crude fiber digestibility.

NFE digestibility

Similar to the findings were reported by Arvindraj (2012) [2] in case of growing crossbred male calves and Tamang and Samanta (1993) [8] in goats.

Conclusion

It can be concluded that as that digestibility of protein was improved though it was non-significant, which indicates the good utilization of protein after inclusion of Azolla however effect of feeding of Azolla were found positive on growth parameters on Marwari stallion which is a good indication for use of Azolla in feeding as a supplement without any adverse effect in this arid region of Rajasthan.

References

1. AOAC. Official methods of analysis, 18th Edition. Association of Official Analytical Chemists, Washington, D.C, 2005.
2. Arvindraj N. Chemical composition & nutritional evaluation of azolla microphylla as a feed supplement for cattle. MVSc. Thesis, NDRI, Kalyani, West Bengal, India, 2012.
3. Ghodake SS, Fernandes AP, Darade V and Zagade BG. Effect of different levels of azolla meal on feed intake of osamanabadi kids. Vet. Sci. Res. J. 2011; 2(1-2):22-24.
4. Indira D, Rao KS, Suresh J, Naidu KV and Ravi A. Azolla (*Azolla pinnata*) as feed supplement in buffalo calves on growth performance. Indian J Anim. Nut. 2009; 26(4):345-348.
5. Khare AK. Effect of *Azolla microphylla* supplementation on growth rate and blood constituents of crossbred female calves (Doctoral dissertation, NDRI, Karnal), 2014.
6. NRC. Requirement of Horses. 6th revised ed. National Research council, Natl. Acad. Press, Washigton D.C., USA, 2007.
7. Roy DC, Pakhira MC, Roy M. Estimation of amino acids, minerals and other chemical compositions of azolla. Advan. Life Sci. 2016; 5(7):2692-2696.
8. Tamang Y, Samanta G. Feeding value of Azolla (*Azolla Pinnata*) as aquatic fern in black Bengal goats. Indian J Anim. Sci. 1993; 63(2):188-191.